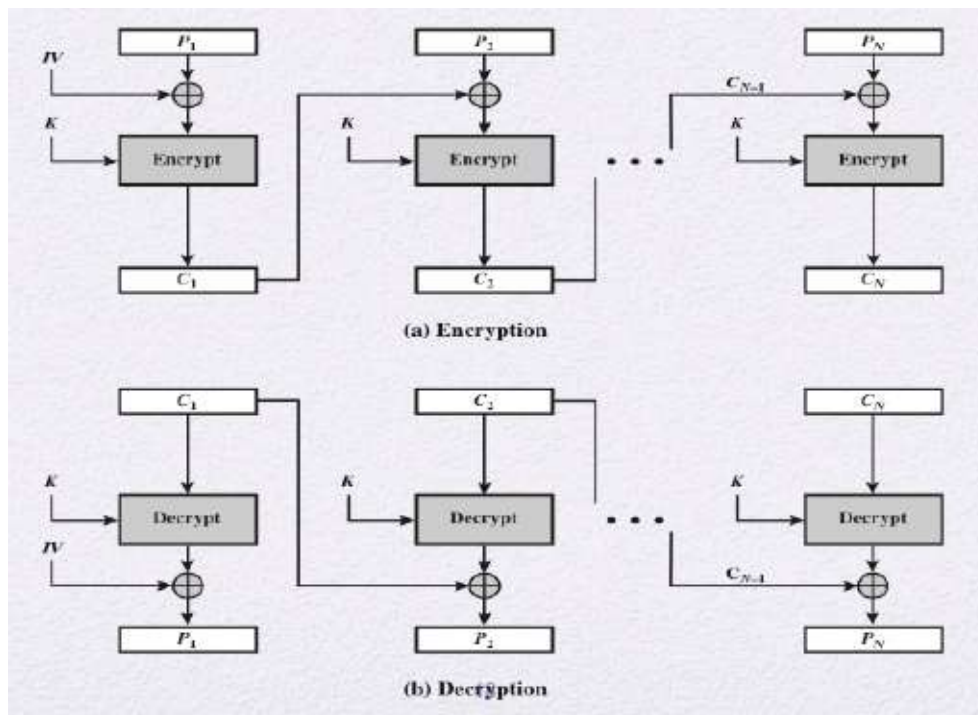


Performance and Security Analysis Between AES and RNA-DNA Image Encryption

● CBC Mode and ECB Mode:

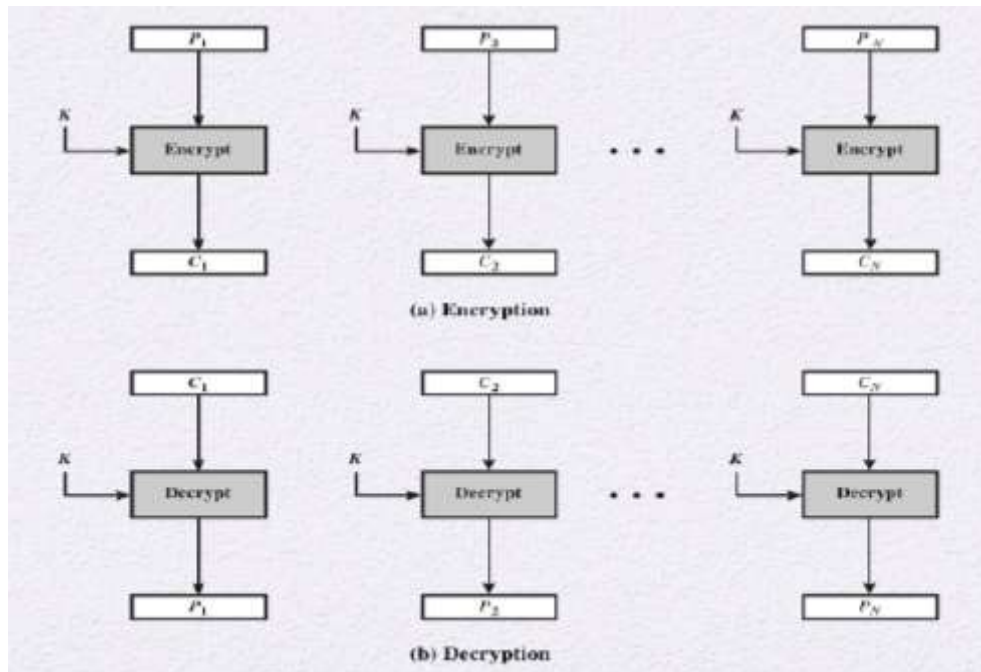
CBC (Cipher Block Chaining) Mode:

The input to the encryption algorithm is the XOR of the next block of plaintext and the preceding block of ciphertext.


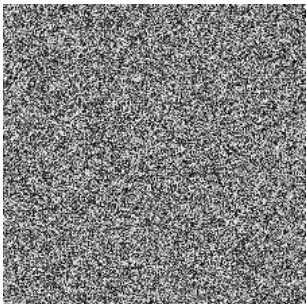
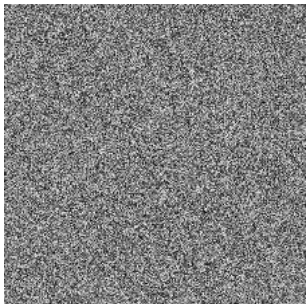
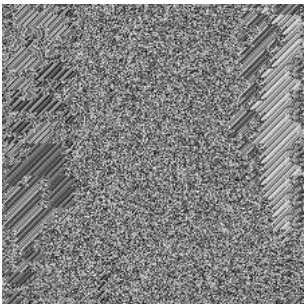



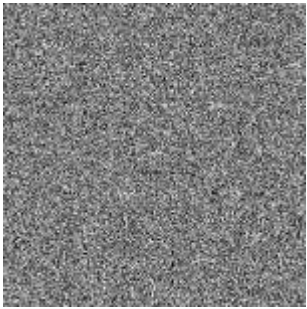
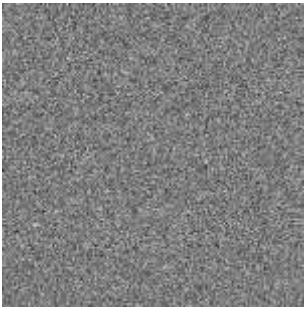
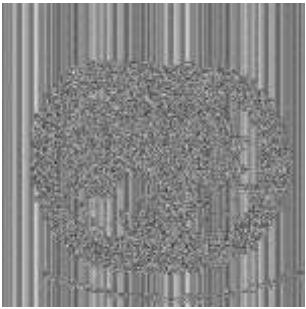
ECB (Electronic Codebook) Mode:


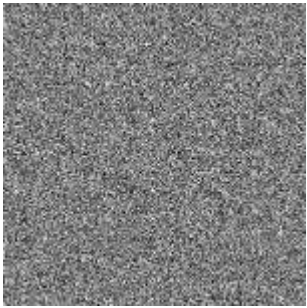
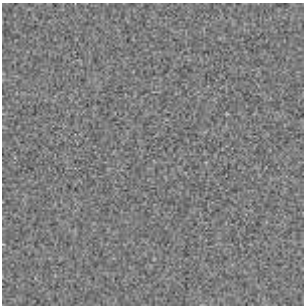
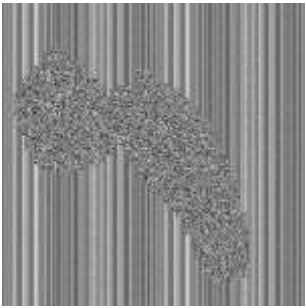
Each block of plaintext bits is encoded independently using the same key.


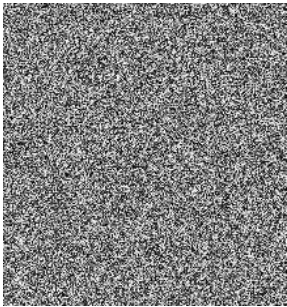
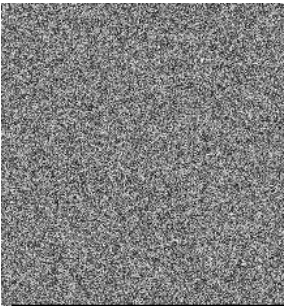
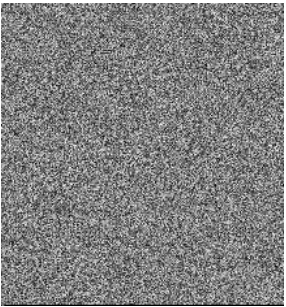


● **Result:**

Original (img10)	RNA-DNA	AES-CBC	AES-ECB
			

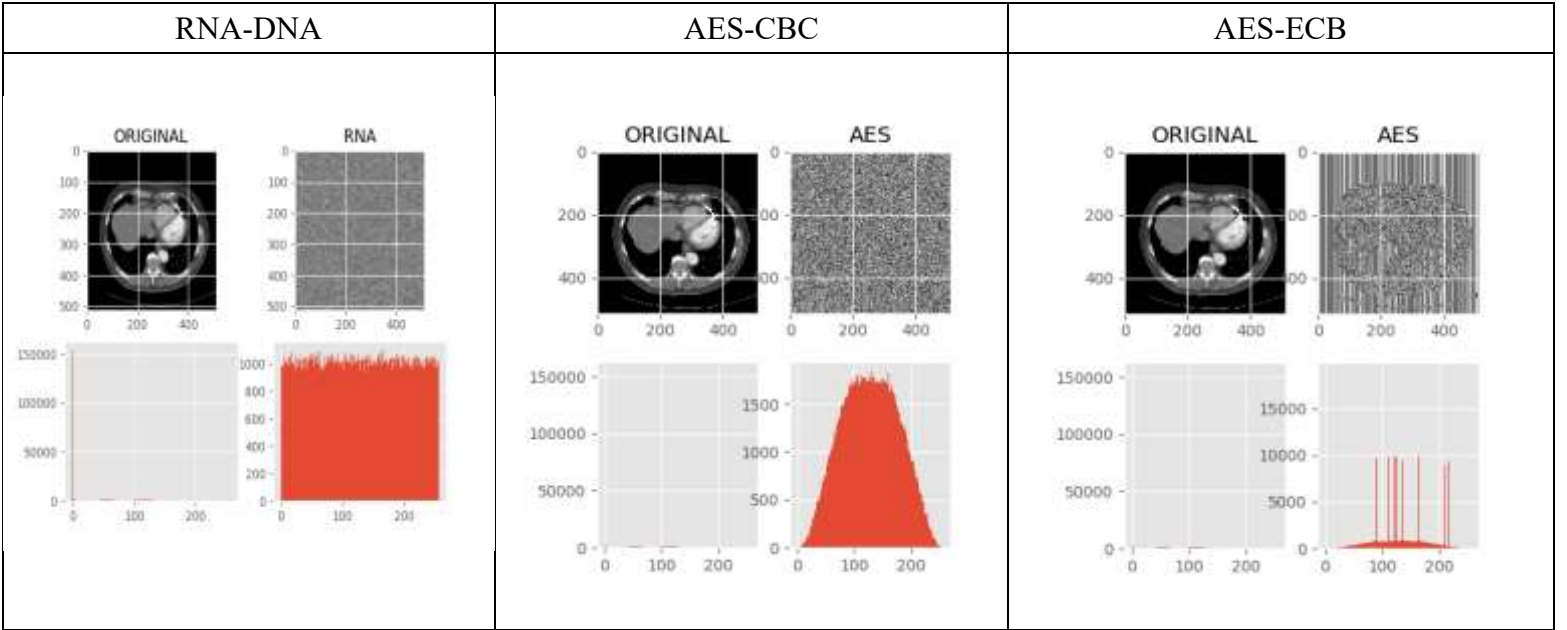
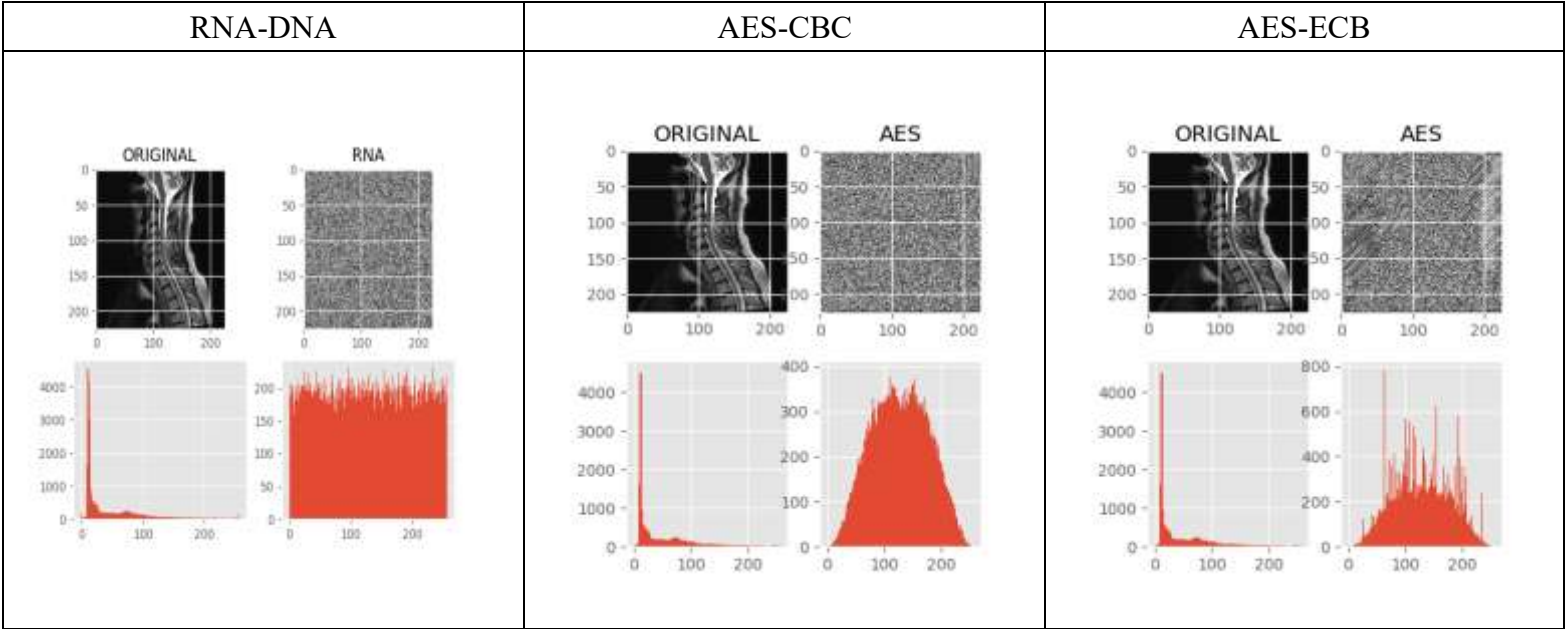
Original (img13)	RNA-DNA	AES-CBC	AES-ECB
			

Original (img17)	RNA-DNA	AES-CBC	AES-ECB
			

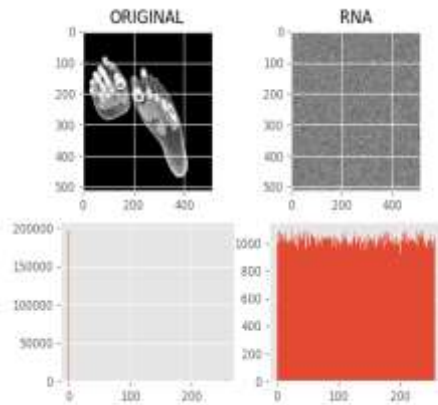
Original (img66)	RNA-DNA	AES-CBC	AES-ECB
			

A. Statistical Analysis

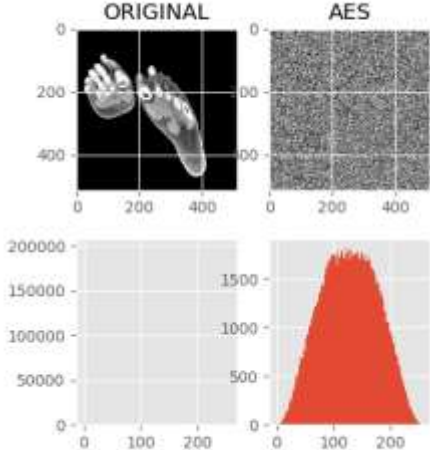
- 1) Histogram (provide any clue to employ any statistical analysis attack on the encryption image)



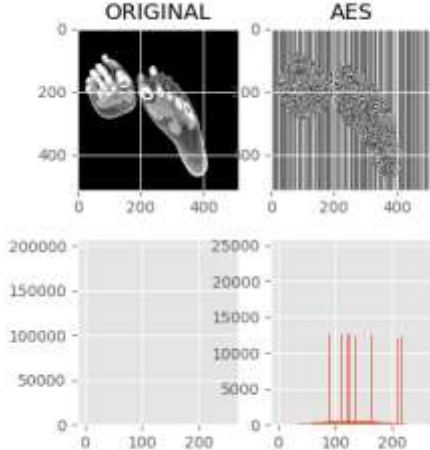
RNA-DNA



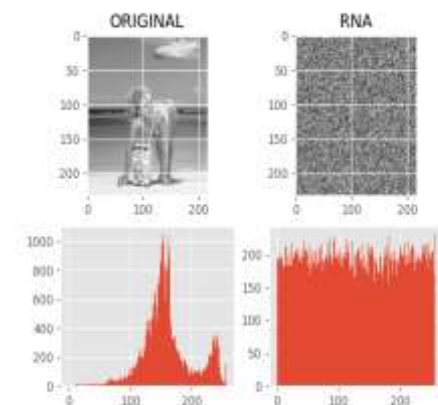
AES-CBC



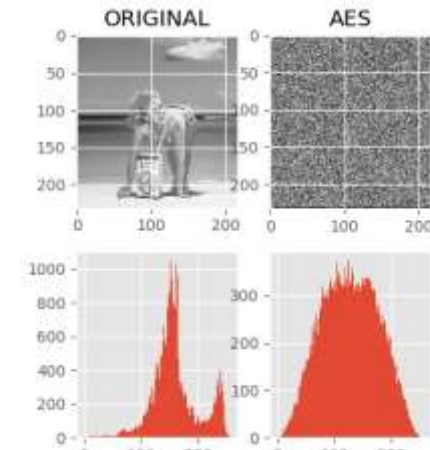
AES-ECB



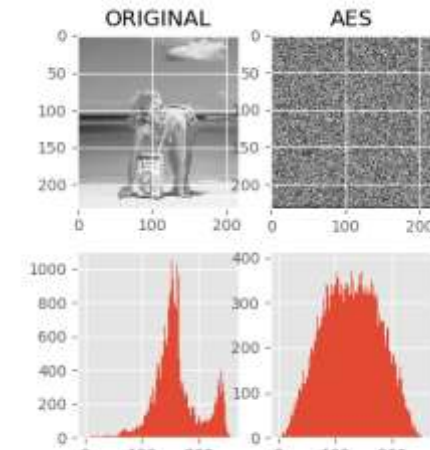
RNA-DNA



AES-CBC



AES-ECB

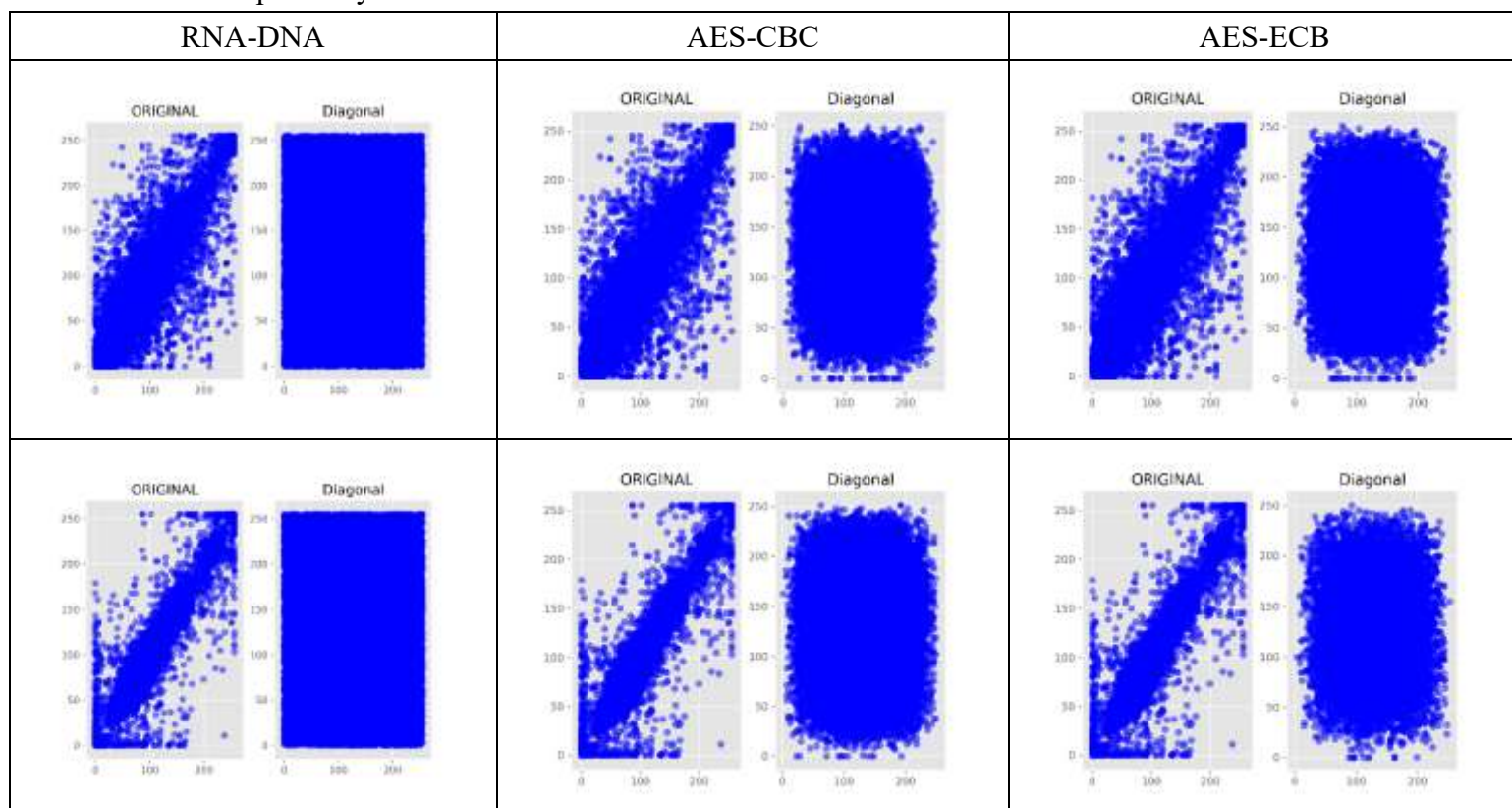


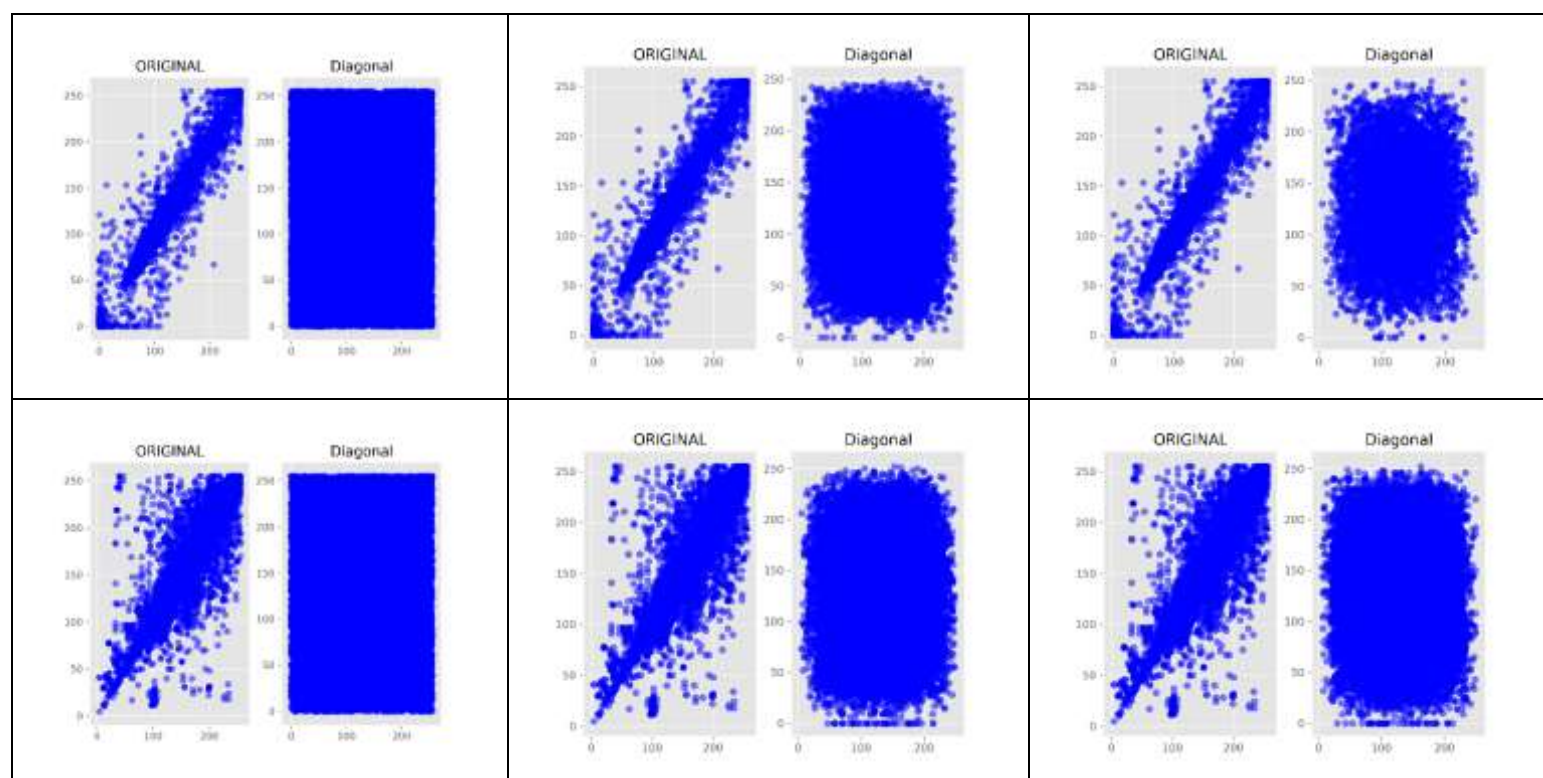
2) Correlation Analysis of Two Adjacent Pixels

Correlation Analysis of Ciphered Image

	Image	Horizontal	Vertical	Diagonal
10	RNA-DNA	-0.0069	-0.002	0.0183
	AES (CBC)	0.0213	-0.0143	-0.0071
	AES (ECB)	0.0261	0.0346	0.0721
13	RNA-DNA	0.0111	-0.0276	-0.0026
	AES (CBC)	-0.0044	0.0008	0.0061
	AES (ECB)	0.4743	-0.2188	-0.2159
17	RNA-DNA	0.0027	0.0163	0.0016
	AES (CBC)	0.0041	-0.0044	0.0058
	AES (ECB)	0.6981	-0.3189	-0.3115
66	RNA-DNA	0.0072	-0.0088	-0.006
	AES (CBC)	0.0079	-0.0115	-0.0015
	AES (ECB)	0.0156	-0.0355	0.0014

From top to down, show the correlation analysis result of image 10, 13, 17, 66, respectively.





B. Sensibility Analysis

1) Differential Attack(NPCR 、UACI)

Image 10

		RNA-DNA	AES-CBC	AES-ECB
NPCR	RUN 1	0.997847	0.997847	0.997985
	RUN 2	0.995477	0.997985	0.997985
	RUN 3	0.99917	0.997906	0.997985
	Average	0.997498	0.997913	0.997985
UACI	RUN 1	0.328285	0.368189	0.369524
	RUN 2	0.340357	0.368879	0.369524
	RUN 3	0.326552	0.367884	0.369516
	Average	0.331732	0.368317	0.369521

Image 13

		RNA-DNA	AES-CBC	AES-ECB
NPCR	RUN 1	0.995152	0.998138	0.998154
	RUN 2	0.997524	0.998085	0.998154
	RUN 3	0.995728	0.998096	0.998154
	Average	0.996134	0.998107	0.998154
UACI	RUN 1	0.334364	0.400719	0.425438
	RUN 2	0.340444	0.400252	0.425441
	RUN 3	0.338779	0.400246	0.425442
	Average	0.337862	0.400406	0.42544

Image 17

		RNA-DNA	AES-CBC	AES-ECB
NPCR	RUN 1	0.995155	0.998749	0.998787
	RUN 2	0.99667	0.998783	0.998787
	RUN 3	0.995987	0.998848	0.998787
	Average	0.995937	0.998793	0.998787
UACI	RUN 1	0.334364	0.438207	0.472142
	RUN 2	0.340444	0.438276	0.472145
	RUN 3	0.338779	0.437886	0.472146
	Average	0.337862	0.438123	0.472145

Image 66

		RNA-DNA	AES-CBC	AES-ECB
NPCR	RUN 1	0.997239	0.994637	0.993763
	RUN 2	0.995551	0.99412	0.993763
	RUN 3	0.994736	0.994696	0.993763
	Average	0.995842	0.994485	0.993763
UACI	RUN 1	0.333569	0.227215	0.224651
	RUN 2	0.339571	0.227923	0.224652
	RUN 3	0.339571	0.225827	0.224658
	Average	0.332441	0.226988	0.224653

2) Information Entropy Analysis

	Original	RNA-DNA	AES-CBC	AES-ECB
Image 10	6.19884089341	7.99617046439	7.63783426615	7.54539756786
Image 13	4.02843345403	7.99929526227	7.63878294346	6.40051673297
Image 17	2.64166441471	7.99930342855	7.63785855258	5.57253834808
Image 66	7.08471964285	7.99625431755	7.63612423939	7.63425886866

3) Time Analysis

	RNA-DNA	AES-CBC	AES-ECB
Image 10	2.826	0.005	0.011
Image 13	14.927	0.008	0.012
Image 17	14.883	0.017	0.007
Image 66	2.977	0.003	0.008